INFORMATIONAL LOGIC IV

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In this part of the essay the following topics of the informational logic (IL) are discussed: transformational rules of IL and a surveying conclusion concerning the formal IL. Various informational modi of informational transformation are presented. This part of the essay includes also the concluding remarks which concern IL in its entirety (references [15], [16], [17], and this essay).

Within transformational rules of IL, the following rules and modi are determined and examined: uniform and non-uniform informational substitution, informational replacement, and modus informationis with the topics as informational implication, informational modus ponens, modus tollens, modus rectus, modus obliquus, modus procedendi, modus operandi, modus possibilitatis, modus necessitatis, and further rules of Informing and the openness of introducing new transformational rules.

INFORMACIJSKA LOGIKA IV. V tem delu spisa se obravnavata še dve naslovni poglavji *informacijske logike* (IL): transformacijska pravila IL in pregled sklepov, ki zadevajo IL. Prikazanih je nekaj informacijskih modusov informacijske transformacije. Ta del spisa vključuje tudi sklepne opombe, ki se nanašajo na celoten spis o IL (na navedbe [15], [16], [17] in na ta spis).

V okviru transformacijskih pravil IL se opredeljujejo in raziskujejo tale pravila: uniformna in neuniformna informacijska substitucija, informacijska zamena in modus informationis z naslovi kot so informacijski modus ponens, modus tollens, modus rectus, modus obliquus, modus procedendi, modus operandi, modus possibilitatis, modus necessitatis in dalje pravila informiranja in odprtost uvajanja novih transformacijskih pravil.

II.4. TRANSFORMATION RULES OF INFORMATIONAL LOGIC

Information is the fuel of cognition. At its most basic level, information is a matter of structure interacting under laws. The notion of information thus reflects the (relational) fact that a structure is created by the impact of another structure. The impacted structure is an encoding, in some concrete form, of the interaction with the impacting structure. Information is, essentially, the structural trace in some system of an interaction with another system; it is also, as a consequence, the structural fuel which drives the impacted system's subsequent processes and behavior.

Radu J. Bogdan [13] 81

II.4.0. Introduction

By transformation rules, informational formulae can be transformed into different ones, which might have simpler, more complex, and also essentially different form and meaning in regard to the previous formulae. It is not always quite clear if formatting, axiomatizing, and transforming approaches can be separated from each other in a strictly evident or clear way. For instance, operations of informational particularization and universalization can have formatting as well as axiomatizing and transforming nature. Within IL, transformation rules transform axioms and already transformed formulae (iwffs) in a uniform, non-uniform, and modal (conditional, dependent, ontological, possible, necessary, true, false, random, etc.) way.

In regard to the uniform and non-uniform substitution there is nothing essentially new to saying. A uniform substitution of variables in a formula is the most common mood of substitution in mathematical formulae. With uniform substitution all variables of the same type will at a time be replaced by a determined formula. In the case of a non-uniform substitution this principle can be violated, thus, in some occurrences a variable will be replaced by a given formula and some not. In this way, non-uniform substitution offers more freedom as compared with uniform substitution.

The next possibility of substitution is the so-called informational replacement. In this case, a formula in a given formula can be replaced by another formula. Such a replacement can be uniform as well as non-uniform which depends on particular occurrences of a formula. As we shall see, the approach of informational replacement can lead to ambiguities when occurrences of distinct formulae overlap each other. In such cases strict rules of substitution must be determined to enable, for instance, substitutions in a parallel or simultaneous manner.

The most diverse transformation of formulae is possible by the use of the so-called informational modi. These various kinds of transformation, of information in general and of iwffs in particular, can be marked simply by modus informationis (MI). MI belongs to the central notions which concern informational transformation rules. MI is in fact a metainformational transformation rule, which by itself as an informational formula (iwff) can be, for instance, non-uniformly particularized, universalized, or informationally modified (by formatting, axiomatizing, and transforming). When particularizing or universalizing the so-called modus informationis, the following modi can be observed: modus ponens, modus tollens, modus rectus, modus obliquus, modus vivendi, modus procedendi, modus operandi, modus possibilitatis, modus necessitatis, etc. Various kinds of informational transformation arise within Informing of information with its arising, and various transforming principles are simply adopted with the embedded (incoming) information. Thus, transformational modi can be understood as essential, existential, and arising phenomena of the entire informational realm.

The main characteristics of any informational modus is the so-called informational extraction (coming into existence) of an arising informational part, which follows as an informational consequence from the current state of a relevant informational phenomenon. This process of extraction of information may concern very different notions, such as implication in traditional logic, detachment in modal logic, modus vivendi under circumstances of survival, modus operandi under circumstances of a possible success, etc. Particular informational modi appear to be only intentional, believing, teleological, etc. mechanisms of informational arising from an antecedent, conditioning, basic, causal, etc. into a consequent, resultant, non-basic, sequential, etc. informational relevance.

To shortly summarize the possibilities of iwffs transformation we can state the following: A set of informational transformation rules (ITR) licenses various informational operations on informational axioms and also on iwffs obtained by previous application of the ITRs. The iwffs obtained by applying of ITRs will be called informational theorems. An iwff is either an informational axiom or informational theorem of a given informational system. Within this system, an iwff is often called informational thesis.

II.4.1. Rules of Uniform and non-Uniform Informational Substitution

II.4.1.0. Introduction

Substitution belongs to the most general procedures of replacement of variables by formulae within symbolic formulae. A variable, or generally a symbol, is simply replaced by another sequence of symbols (formula) throughout a given formula or only some of variable occurrences are replaced while others are left unchanged. In fact, the process of substitution can be strictly determined or can be free in regard to the replacements of occurrences of a variable. In the first case we have to do with the so-called uniform, and in the second case with the so-called non-uniform substitution.

II.4.1.1. Rules of Uniform Substitution within an IWFF

For uniform substitution (without particularization and universalization) it is possible to state the following rule:

[Transformation Rule]^{DF1}:
We can adopt the following ITR of the uniform informational substitution: the result of a uniform replacing of any informational variable (the operand as well as the operator one) in an informational thesis by any iwff and sub-iwff, respectively, is itself an informational thesis. This rule can be formalized in the following way: let $_u\mathfrak{S}$ be the operator of uniform substitution and φ an iwff in which operand and operator variables $\xi, \eta, \ldots, \zeta$ occur, so that it is possible to write the functional form $\varphi(\xi, \eta, \ldots, \zeta)$. Let arbitrary iwffs $\alpha, \beta, \ldots, \gamma$ be given and let token "|" be the delimiter, which marks the end of $\mathfrak{S}$-operation. Then the result of the operation of uniform substitution is as follows:

$$_u\mathfrak{S}^{\xi,\, \eta,\, \ldots,\, \zeta}_{\alpha,\, \beta,\, \ldots,\, \gamma}\, \varphi(\xi, \eta, \ldots, \zeta)| = \varphi(\alpha, \beta, \ldots, \gamma)$$

Instead of this symbolism of substitution we can use the informational one, for instance,

$$\alpha, \beta, \ldots, \gamma \models_{\mathfrak{S}} \xi, \eta, \ldots, \zeta \perp_u$$
$$\varphi(\xi, \eta, \ldots, \zeta) \models_{=} \varphi(\alpha, \beta, \ldots, \gamma)$$

The meaning of this formula is the following: $\alpha, \beta, \ldots, \gamma$ substitute ($\models_{\mathfrak{S}}$) $\xi, \eta, \ldots, \zeta$ uniformly in ($\perp_u$) the formula $\varphi(\xi, \eta, \ldots, \zeta)$ resulting in ($\models_=$) the formula $\varphi(\alpha, \beta, \ldots, \gamma)$. Uniformly means that informational sets of entities $\alpha, \beta, \ldots, \gamma$ and $\xi, \eta, \ldots, \zeta$ are in the one-to-one correspondence. ■

II.4.1.2. Rules of Non-Uniform Substitution within an IWFF

If the uniform substitution within a formula $\varphi(\xi, \eta, \ldots, \zeta)$ always gives a single result, denoted as a formula $\varphi(\alpha, \beta, \ldots, \gamma)$, then the non-uniform substitution can give many different results, which can be denoted by a set of formulae $\{\varphi(\xi, \alpha, \eta, \beta, \ldots, \zeta, \gamma)\}$. Thus, we can adopt the following rule:

[Transformation Rule]^{DF2}:
We take ${}_n\mathfrak{S}$ as the operator of a non-uniform substitution and $\varphi(\xi, \eta, \ldots, \zeta)$ as an iwff, in which $\xi, \eta, \ldots, \zeta$ are occurrences of informational operand and operator variables. Now, let $\alpha, \beta, \ldots, \gamma$ mark arbitrary iwffs and sub-iwffs, respectively. Then we have a set $\{\varphi\}$ of results of the non-uniform substitution, i.e.,

$$ {}_n\mathfrak{S}^{\xi,\, \eta,\, \ldots,\, \zeta}_{\alpha,\, \beta,\, \ldots,\, \gamma}\, \varphi(\xi, \eta, \ldots, \zeta)| = \{\varphi(\xi, \alpha, \eta, \beta, \ldots, \zeta, \gamma)\} $$

where the appearance of informational variables $\xi, \eta, \ldots, \zeta$ in particular elements of $\{\varphi\}$ is not necessarily certain. Informationally, we can symbolize this formula also by

$$ \alpha, \beta, \ldots, \gamma \models_{\mathfrak{S}} \xi, \eta, \ldots, \zeta \perp_n \varphi(\xi, \eta, \ldots, \zeta) \models_= \{\varphi(\xi, \alpha, \eta, \beta, \ldots, \zeta, \gamma)\} $$ ■

II.4.2. Rules of Informational Replacement

The rule of replacement is a generalization of the rule of substitution, which concerns only particular variables like operands and operators. Replacement does not search only for variables but for symbolic sequences within an iwff, which may be particular iwffs or sub-iwffs occurring within a source iwff. In general, by a replacement operation, the occurring iwffs can be replaced by other iwffs. This kind of operation is generally not uniform and cannot be always unique because of the occurring formulae overlapping within an iwff. But, it is more or less obvious that through an informational replacement very complex changes or essential transformations of existing iwffs can be achieved. Informational replacement will belong to the legal rules of informational formula transformation.

From the philosophical point of view, informational replacement is an operation, by which given informational associations are replaced by other associations. Here, an association can be understood as a complex, actualized informational entity, which calls for an adequate informational completion, change, or reduction. In this respect, informational replacement is also a very habitual process of living information.

Let us determine the rule of informational replacement! The question is what to do in case of overlapping of the occurring iwffs within a given iwff. It is of course possible to prescribe particular strategies or rules of formula replacements. However, we shall not deal with such particular "algorithms" yet. We can simply state that it will not be prescribed in advance how the replacement process is to happen precisely. So, let us have the following rule:

[Transformation Rule]^{DF3}:
Let ${}_x\mathfrak{R}$ be an x-ized informational operator of replacement, where x is a replacement operator particularization. Let φ be a given iwff upon which the operator ${}_x\mathfrak{R}$ will act. In general, this formula may or may not include some particular iwffs, relevant to the replacement, which could be replaced by formulae $\alpha, \beta, \ldots, \gamma$. Let it be

$$ \varphi = \varphi(\mathfrak{A}, \mathfrak{B}, \ldots, \mathfrak{C}) $$

where $\mathfrak{A}, \mathfrak{B}, \ldots, \mathfrak{C}$ mark the occurring or non-occurring iwffs within φ. Then,

$$ {}_x\mathfrak{R}^{\mathfrak{A},\, \mathfrak{B},\, \ldots,\, \mathfrak{C}}_{\alpha,\, \beta,\, \ldots,\, \gamma}\, \varphi(\mathfrak{A}, \mathfrak{B}, \ldots, \mathfrak{C})| = \{\varphi(\mathfrak{A}, \alpha, \mathfrak{B}, \beta, \ldots, \mathfrak{C}, \gamma)\} $$

As it is seen from the last expression, the operation of replacement results in a set of possible iwffs. ■

We can understand how the operator '=' in the last formula could be replaced also by a particularized operator '$\models$', when the meaning would be that the operation of replacement on the left side of '=' informs the set of possible iwffs on the right side of '='.

II.4.3. Rules of Modus Informationis

II.4.3.0. Introduction

Modus informationis will embrace the broadest realm of informational inferring or of informational syllogism. In this respect, modus informationis will be a kind of observational, investigational, and comprehensional development of information, by means of which a part of arising information will be extracted (recognized, comprehended, and separated) from an existing informational entity (unity). Modus informationis has to be understood also as special, additional (special) mechanism for the development of informational formulae (iwffs), of their arising. In real cases, under modus informationis it will be possible to comprehend any informational arising from an already existing arising of information.

In this section we shall introduce the notion of a suitable class of informational moods or modi of information and its Informing. The goal of this determination will be to get a general, powerful, and indefinitely arising set of transformation rules in the form of iwffs, by which other and also informational modi-concerned iwffs will be transformed from one form to another. The so-called modus of information in our case will be regular information (a concrete iwff) for transforming iwffs. For such a modus we shall introduce the general name modus informationis (MI).

As information (a given iwff for transformation purposes) an informational modus describes the arising of information, which can concern, for instance, Being, existence, state, form, process, structure, organization, etc. of information. Modus is informational property, essence, existence of informational extraction through changing, arising, and vanishing of information, is information of extracting phenomenology and is as such the immanent and regular property of information. A steady, unchangeable modus is similar to an attribute or informationally to a datum. In general sense, modus is information of changing of attributes, which can be understood as informational constants or informationally unchangeable types. Modus is a regular informational process with intention how to extract and by its application to change, generate, develop, or dismiss certain information on which it is applied, how to modify information and enable its arising into new, contrary, richer, poorer, or essentially different information. Informational modus is a general characteristics of information and we use this term to explicate it as a principle, which is relevant to the development, deduction, induction, inference, reasoning, or, generally, to the arising of informational formulae.

II.4.3.1. The Rough Structure of Modus Informationis

What is modus informationis? Modus informationis (MI) means any informationally arising transformation of information. MI is information by itself, is an arising transformational Informing. Let us list some of necessary and possible conclusions:

(1) It is evident that MI as a generalization of the known modi has to preserve the so-called informational transformation by detachment or possibilities of informational extraction of subinformation from a broader informational realm. Thus, MI includes the informational operator of detachment, the most general one, which can be marked by $\models_{\rightarrow}$ or $\models_{\leftarrow}$ or shortly by $\rightarrow$ or $\leftarrow$, respectively. It is to understand that there exists a semantic difference between informational implication ($\Rightarrow$ and $\Leftarrow$) and informational extraction, i.e. detachment ($\rightarrow$ and $\leftarrow$).

(2) What do we have on the antecedent (or "numerator") side of a detachment formula? There are usually several informational components, denoted by variables $\alpha, \beta, \ldots, \gamma$ and connected by an informational operator of the type "$\models_{\text{comma}}$", "$\wedge$", or ",".

(3) On the consequent (or "denominator") side of a detachment formula let it be an informationally simple or complex component marked by δ.

(4) According to paragraphs (1), (2), and (3), the rough structure of MI has the form

$$(\alpha \models_{\wedge} \beta \models_{\wedge} \ldots \models_{\wedge} \gamma) \models_{\rightarrow} \delta$$

(5) How is the consequence δ structurally dependent on the variable (arising) antecedent components $\alpha, \beta, \ldots, \gamma$? What are informational differences among antecedent components? Components $\alpha, \beta, \ldots, \gamma$ are mutually dependent and thus informational differences among them can constitute the nature of the consequence δ.

(6) The general case of MI exposed in paragraphs (1) through (5) can now be particularized and universalized to obtain, for instance, the cases of modus ponens, modus tollens, modus rectus, modus vivendi, etc.

II.4.3.2. Informational Implication

Informational implication, marked by informational operator $\Rightarrow$ and used in several previous definitions, might be viewed as the most primitive form of MI. If information α implies information β, then this fact within IL may sound as a rule, that the occurrence of α within an iwff can be replaced by β. Of course, the notion of informational implication embraces also several forms of the so-called mathematical implications, for instance, the so-called substantial (material), primitive, traditionally logical, effectively logical, effectively true, critical, basic implication, etc.

Further, informational implication as an iwff of the form $\alpha \Rightarrow \beta$ has to be understood as a particularization of the most general formula of Informing $\alpha \models \beta$. However, formula $\alpha \Rightarrow \beta$ has to be understood as universalization of, for instance, known mathematical (logical) forms of implication.

II.4.3.3. The Case of Informational Modus Ponens

> Common sense had almost no inkling that physical reality is mathematical. Why would it be better off when it comes to the formal character of cognition?
>
> Radu J. Bogdan [13] 118

Modus ponens concerns, for instance, one of the very elaborated and practiced rule of formula transformation in mathematics. It is the most known modus in mathematical theories. In fact, it is a modus of limited reasoning or strict inference which uses the so-called disjunctive syllogism, where affirming one of given possibilities excludes other possibilities and vice versa. In this section we shall determine various informational possibilities of the so-called informational modus ponens.

[Transformation Rules]^{DF4}:
Let us determine the traditional and most common rule of modus ponens! Let α and β be informational entities and let $\Rightarrow$ be the operator of informational implication. The rule is the following:

$$\frac{\alpha,\ \alpha \Rightarrow \beta}{\beta}$$

To be more precise, this rule can be rewritten as

$$(\alpha \wedge (\alpha \Rightarrow \beta)) \Rightarrow \beta$$

which comes closer to the iwff of IL. But it must be kept in mind that the traditional logic deals with truth and falsity, and so the traditional interpretation of modus ponens within IL would be

$$((((\alpha \models_T) \wedge ((\alpha \Rightarrow \beta) \models_T))\models_T) \Rightarrow (\beta \models_T)) \models_T$$

This formula enables the understanding of the so-called detachment of β (or extraction of β from the antecedent of modus ponens) as a true informational entity within the informational realm of $\alpha \Rightarrow \beta$. ■

The meaning of the last formula is that modus ponens, in its entirety, informs true or that it is by itself a true proposition. The detachment of β means, that β informs true and that on account of this truth it can be recognized as a valid proposition. However, two presumptions must be true, namely, that α informs true and that the formula $\alpha \Rightarrow \beta$ in this particular case informs true (this yields that the conjunction of α and $\alpha \Rightarrow \beta$ informs true too).

Let us now show further possible informational universalization of modus ponens in the last definition! This could be a regular way how from a particular case (traditional modus ponens) a more universal case can be obtained.

[Transformation Rules]^{DF5}:
Let us rewrite the basic formula of modus ponens in the following manner:

(1) $$(\alpha \models_\wedge (\alpha \models_\Rightarrow \beta)) \models_\Rightarrow \beta$$

This formula has up to now not been essentially different from the traditional formula. The next step can be its radical universalization by replacing all explicit operators in the formula by the most universal operator $\models$:

(1a) $$(\alpha \models (\alpha \models \beta)) \models \beta$$

This formula says that α in some way informs the process $\alpha \models \beta$ and that the entire process $\alpha \models (\alpha \models \beta)$ finally informs β. It means simply that the entire process $\alpha \models (\alpha \models \beta)$ informs one of its components, namely β. This result is a pure consequence of the radical universalization of modus ponens. Simultaneously, this universalization shows the essential point of modus ponens, namely, that no other component than β is informed by the process $\alpha \models (\alpha \models \beta)$ so far. It means that, for instance, α must remain as it is or at least must not be informed by $\alpha \models (\alpha \models \beta)$. This universalization shows evidently the problem which could appear in case of a real, living information where the Informing to α has to be blocked (inhibited) against the Informing of $\alpha \models (\alpha \models \beta)$. This request can be expressed explicitly by the attributed formula (modus)

(1b) $$(\alpha \models (\alpha \models \beta)) \not\models \alpha$$ ■

[Transformation Rules]^{DF6}:
As a rule, modus ponens informs true in its details and in its entirety, as shown in [Transformation Rules]^{DF4}. Let us rewrite this rule in the following (postfix) manner:

(2) $$((((\alpha \models_T) \models_\wedge ((\alpha \models_\Rightarrow \beta) \models_T)) \models_T) \models_\Rightarrow (\beta \models_T)) \models_T$$

The symmetric (prefix) version of (2) would be

(3) $$\models_T ((\models_T ((\models_T \alpha) \models_\wedge (\models_T (\alpha \models_\Rightarrow \beta)))) \models_\Rightarrow (\models_T \beta))$$

The next step can be a radical universalization of formulae (2) and (3) in the following way:

(2a) $$((((\alpha \models) \models ((\alpha \models \beta) \models)) \models) \models (\beta \models)) \models$$

(3a) $$\models ((\models ((\models \alpha) \models (\models (\alpha \models \beta)))) \models (\models \beta))$$

These formulae tell that Informings of α, where α informs ($\alpha \models$) and is informed ($\models \alpha$), inform the Informing of the process $\alpha \models \beta$ and that entire Informings of processes $(\alpha \models) \models ((\alpha \models \beta) \models)$ and $(\models \alpha) \models (\models (\alpha \models \beta))$, respectively, finally inform Informings of β ($\beta \models$ and $\models \beta$, respectively). Similarly to (1b) in the previous definition, the following two formulae can be attributed to (2a) and (3a), respectively:

(2b) $$(((\alpha \models) \models ((\alpha \models \beta) \models)) \models) \not\models (\alpha \models)$$

(3b) $$(\models ((\models \alpha) \models (\models (\alpha \models \beta)))) \not\models (\models \alpha)$$ ■

In some cases it could be useful to introduce the so-called extraction (separation, detachment) line to improve the visibility of an informational modus. In modus ponens it would be, for instance,

$$\frac{\alpha \wedge (\alpha \Rightarrow \beta)}{\beta}\ (\Longrightarrow) \quad \text{or} \quad \frac{\alpha \wedge (\alpha \Rightarrow \beta)}{\beta}\ (\models\!=)$$

instead of the traditional expression.

We see how formulae of informational modi are becoming iwffs and can be understood as such. We have to keep in mind that modi are informational rules for transforming other informational formulae. In this respect the meaning of the extraction operation (line of detachment) is, for instance, 'affirms', 'asserts', 'maintains', 'puts_out_to_interest', 'considers', etc. Thus, operation of informational extraction can be understood as an informational particularization.

[Transformation Rules]^{EX1}:
Within informational logic it is possible to construct an infinite set of informational modi ponens. Let us list some characteristic examples! The first example is, for instance,

the modus ponens of belief, where $\models_B$ is the informational operator of believing. There is:

$$\frac{\models_B \alpha,\ \models_B (\alpha \Rightarrow \beta)}{\models_B \beta}$$

This rule says: if α is believed and if $\alpha \Rightarrow \beta$ is believed, then β is believed. To be consequent to resulting from our believing, we have to attribute to this formal believing implicitly the following:

$$\models_B (\models_B \alpha,\ \models_B (\alpha \Rightarrow \beta))$$

and

$$\models_B (\models_B (\models_B \alpha,\ \models_B (\alpha \Rightarrow \beta)) \ / \ (\models_B \beta))$$

We certainly have to believe the entire antecedent as it is composed and we have to believe in modus ponens (of believing). Informational operator '/' was introduced to replace the usual detachment operation.

A similar example can be constructed for the case of knowledge, where

$$\frac{\models_K \alpha,\ \models_K (\alpha \Rightarrow \beta)}{\models_K \beta}$$

etc. However, we can still put the question what would the so-called modus ponens of Informing be. ■

II.4.3.4. The Case of Informational Modus Tollens

> Without a clear teleological hold on distal targets, and a clarification of what this means, we might only get proximal semantics, and we do not want that. For if proximal semantics makes sense, then my entire approach to semantic information doesn't. Hence the urgent need for modus tollens.
>
> Radu J. Bogdan [13] 100

In general, the modus tollens invalidates, negates, or informationally abolishes a piece of complex information and, in this respect, represents an informational transformation which can be understood as, in some sense, opposite to informational transformation by modus ponens. Of course, modus tollens can be used in traditional theories as a rule of negation. In fact it is a modus of limited reasoning or strict inference which uses the so-called hypothetical syllogism: negating the consequent causes negation of the antecedent.

[Transformation Rules]^{DF7}:
First, let us define the traditional modus tollens! Let α and β be informational entities, $\Rightarrow$ the operator of informational implication, and $\neg$ the symbol of logical negation. By these terms, the rule of traditional modus tollens is the following:

$$\frac{\alpha \Rightarrow \beta,\ \neg \beta}{\neg \alpha}$$

This rule can be logically rewritten into

$$((\alpha \Rightarrow \beta) \wedge (\neg \beta)) \Rightarrow (\neg \alpha)$$

and represents an iwff of IL. However, there is a slight difference when comparing modus ponens and modus tollens, due the appearance of operator $\neg$. Thus, instead of the first interpretation of modus tollens by the formula of detachment, it could be also

$$\frac{\alpha \Rightarrow \beta,\ \beta \neg}{\neg \alpha}$$

This is due to $\beta \neg \alpha$, where the meaning of $\neg$ is the following:

$$\neg =_{Df} (\text{'negates'} \vee \text{'negate'} \vee \text{'is\_negated\_(by)'} \vee \text{'are\_negated\_(by)'})$$

By modus tollens the consequent negates the antecedent.

In terms of traditional logic, modus tollens has to be understood through categories of truth and falsity (at least of some parts of the formula). Thus, a traditional interpretation of modus tollens becomes

$$(((((\alpha \Rightarrow \beta) \models_T) \wedge ((\beta \neg) \models_T)) \models_T) \Rightarrow ((\neg \alpha) \models_T)) \models_T$$

This formula gives the detachment $(\neg \alpha) \models_T$ out of the premise of modus tollens. But, in a certain case, it is possible to explicate the non-informing nature of components which bear the operation of negation $\neg$, for instance

$$(((((\alpha \Rightarrow \beta) \models_T) \wedge (\beta \not\models_T)) \models_T) \Rightarrow (\not\models_T \alpha)) \models_T$$

We have only combined $\neg$ and $\models_T$ into a universal operator $\not\models_T$ which can again be particularized for a certain case. ■

The meaning of the last formula is that modus tollens, in its entirety, informs true. The detachment of $\alpha \not\models_T$ means that α does not inform true. Prior to this, two presumptions have to be true, namely that $\alpha \Rightarrow \beta$ informs true and that β does not inform true.

Now, it is possible to show further informational universalization of modus tollens. Similar to the [Transformation Rules]^{DF5} we can construct the following rule:

[Transformation Rules]^{DF8}:
Let us rewrite the basic formula of modus tollens in the following manner:

(1) $((\alpha \models_{\Rightarrow} \beta) \models_{\wedge} (\beta \neg)) \models_{\Rightarrow} (\neg \alpha)$

This formula of modus tollens has up to now not been essentially different from the traditional formula. The next step of its modification can be its radical universalization by the replacement of all particularized explicit operators in the formula by the most universal operators $\models$ and $\not\models$:

(1a) $((\alpha \models \beta) \models (\beta \not\models)) \models (\not\models \alpha)$

This formula tells that the process $\alpha \models \beta$ informs, in some way, the process $\beta \not\models$ and that the entire process $(\alpha \models \beta) \models (\beta \not\models)$ informs the process $\not\models \alpha$ which concerns one of the components of the process $\alpha \models \beta$, namely, α. This result is a pure consequence of the radical universalization of traditional modus tollens. Simultaneously, this universalization shows the essential point of modus tollens, namely, that no other component than the process $\not\models \alpha$ is informed by the process $(\alpha \models \beta) \models (\beta \not\models)$. This universalization shows the problem which arises in case of a real, living information, where the Informing to $\beta \not\models$ has to be blocked (inhibited) against the Informing of the process $(\alpha \models \beta) \models (\beta \not\models)$. This request can be expressed explicitly by the attributed formula (modus)

(1b) $$((\alpha \models \beta) \models (\beta \not\models)) \not\models (\beta \not\models)$$ ■

[Transformation Rules]^{DF9}:
As a rule, modus tollens informs true in its details and in its entirety, as shown in [Transformation Rules]^{DF7}. This is a fact which roots in the usual true-false categorization of the traditional logic. Let us rewrite this rule in the following (postfix) manner:

(2) $$(((((\alpha \models_{\Rightarrow} \beta) \models_T) \models_{\wedge} ((\beta \models_{\neg}) \models_T)) \models_T) \models_{\Rightarrow} ((\models_{\neg} \alpha) \models_T)) \models_T$$

The symmetric (prefix) version of (2) is

(3) $$\models_T (\models_T ((\models_T (\alpha \models_{\Rightarrow} \beta)) \models_{\wedge} (\models_T (\beta \models_{\neg}))) \models_{\Rightarrow} (\models_T (\models_{\neg} \alpha)))$$

The next step can be a radical universalization of formulae (2) and (3) in the following way:

(2a) $$(((((\alpha \models \beta) \models) \models ((\beta \not\models) \models)) \models) \models ((\not\models \alpha) \models)) \models$$

(3a) $$\models (\models ((\models (\alpha \models \beta)) \models (\models (\beta \not\models))) \models (\models (\not\models \alpha)))$$

These formulae tell that Informings of the process $\alpha \models \beta$, where $\alpha \models \beta$ informs $((\alpha \models \beta) \models)$ and is informed $(\models (\alpha \models \beta))$, inform the Informing of the process $\beta \not\models$ and that the entire Informings of processes $(((\alpha \models \beta) \models) \models ((\beta \not\models) \models)) \models$ and $\models ((\models (\alpha \models \beta)) \models (\models (\beta \not\models)))$, respectively, finally inform Informings $(\not\models \alpha) \models$ and $\models (\not\models \alpha)$, respectively. The first of these integral informational entities informs and the second is informed. Similarly to (1b) in the previous definition, the following two formulae can be attributed to (2a) and (3a), respectively:

(2b) $$((((\alpha \models \beta) \models) \models ((\beta \not\models) \models)) \models) \not\models ((\alpha \models \beta) \models)$$

(3b) $$(\models ((\models (\alpha \models \beta)) \models (\models (\beta \not\models))) \not\models (\models (\alpha \models \beta))$$ ■

We have to mention again that operators $\models$ and $\not\models$ can be non-uniformly replaced by particularized operators and that operators of the type $\not\models$ can be understood as any informational operators of particular non-Informing. Thus, $\models$ and $\not\models$ are in general not operators which exclude exactly each other, but have to be understood as operational variables belonging to various particular classes.

Instead of the traditional expression of modus tollens we can use also expressions

$$\frac{(\alpha \Rightarrow \beta),\ \beta \neg}{\neg \alpha} \quad \text{or} \quad \frac{(\alpha \Rightarrow \beta),\ \beta \neg}{\neg \alpha}$$

Expressions of these kind explicate clearly the extraction or detachment operation, which in the context of modus tollens can be particularized (in the second case) or universalized (in the first case).

[Transformation Rules]^{EX2}:
Within IL we can construct an infinite set of informational modi tollens. Firstly, this infiniteness follows from the unforeseeable possibilities of particularization and universalization of appearing informational operators in a formula (iwff) representing modus tollens. Secondly, as we have learned from several previous cases, a distinct formula of modus tollens can be developed through consideration (introducing) of various forms of Informings of operand variables and processes. This procedure of formula development can lead to a more and more complex expression and the stopping of complexness can be impacted by distinct circumstances (semantics, modus vivendi) in the phase of formula development. Let us look at some of these possibilities.

The first two examples are, for instance, the modi tollens of belief, where $\models_B$ and $\not\models_B$ are informational operators of believing and non-believing. There is:

$$\frac{\models_B (\alpha \Rightarrow \beta),\ \models_B (\neg \beta)}{\models_B (\neg \alpha)} \quad \text{and} \quad \frac{\models_B (\alpha \Rightarrow \beta),\ \models_B (\beta \neg)}{\models_B (\neg \alpha)}$$

or also

$$\frac{(\alpha \Rightarrow \beta) \models_B,\ (\neg \beta) \models_B}{(\neg \alpha) \models_B} \quad \text{and} \quad \frac{(\alpha \Rightarrow \beta) \models_B,\ (\beta \neg) \models_B}{(\neg \alpha) \models_B}$$

The first rule says: if it is believed that α implies β and if it is believed that β is negated, then it is believed that α is negated. The second rule says: if it is believed that α implies β and if it is believed that β negates, then it is believed that α is negated (informationally in an implicit manner by β). The third rule says: if information 'α implies β' believes (or is believable) and if information 'β is negated' believes (is believable), then information 'α is negated' believes (is believable). The fourth rule says: if information 'α implies β' believes (or is believable) and if information 'β negates' believes (is believable), then information 'α is negated' (informationally in an implicit manner by β) believes (is believable).

Similarly to [Transformation Rules]^{EX1} it is possible to express the belief into modus tollens for the upper four cases in the following way:

$$\models_B ((\models_B ((\models_B (\alpha \Rightarrow \beta)) \wedge (\models_B (\neg \beta)))) \,/\, (\models_B (\neg \alpha)))$$

$$\models_B ((\models_B ((\models_B (\alpha \Rightarrow \beta)) \wedge (\models_B (\beta\ \neg)))) \ / \ (\models_B (\neg\ \alpha)))$$

$$(((((\alpha \Rightarrow \beta) \models_B) \wedge ((\neg\ \beta) \models_B)) \models_B) \ / \ ((\neg\ \alpha) \models_B)) \models_B$$

$$(((((\alpha \Rightarrow \beta) \models_B) \wedge ((\beta\ \neg) \models_B)) \models_B) \ / \ ((\neg\ \alpha) \models_B)) \models_B$$

We certainly have to believe the entire antecedents as they are composed (by the operators $\wedge$) and we have to believe the upper rules of modus tollens. Informational operator '/' replaces the usual operation of detachment. ∎

[Transformation Rules]^{EX3}:
The next two examples of modus tollens we are going to examine concern knowledge and awareness. The traditional form of modus tollens of knowledge is, for instance,

$$\frac{\models_K (\alpha \Rightarrow \beta),\ \models_K (\neg\ \beta)}{\models_K (\neg\ \alpha)}$$

This formula has the following meaning: if it is known that α implies β and if it is known that β is negated, then it is known that α is negated. However, we can interpret the operator $\not\models_K$ as 'it_is_not_known' or 'it_does_not know'. Thus, the basic formula of modus tollens of knowledge can be rewritten into the form

$$\frac{\models_K (\alpha \Rightarrow \beta),\ \not\models_K \beta}{\not\models_K \alpha}$$

The meaning of this formula is the following: if it is known that α implies β and if β is not known, then α is also not known. As $\models_K$ and $\not\models_K$ can be particularized in a non-uniform way, the meaning of the operator variable can cover a broad informational realm, which might not have any relation to the opposition of a particular operator belonging to the type $\not\models_K$.

A similar reasoning is possible in case of the so-called awareness ($\models_A$) and unawareness ($\not\models_A$). The traditional form of modus tollens of awareness is

$$\frac{\models_A (\alpha \Rightarrow \beta),\ \models_A (\neg\ \beta)}{\models_A (\neg\ \alpha)}$$

Let us interpret the meaning of this formula: if 'it is aware' (= 'it is consciously evident') that α implies β and if 'it is aware' that β is negated, then 'it is aware' that α is negated. The awareness of $\neg\ \beta$ and $\neg\ \alpha$ can in a particular case be interpreted as unawareness of β and α, respectively. In this case, from the awareness that α implies β and that β is unaware follows that α is unaware. Thus, formula

$$\frac{\models_A (\alpha \Rightarrow \beta),\ \not\models_A \beta}{\not\models_A \alpha}$$

sounds quite reasonably. ∎

In the following examples we shall examine the informational connectedness of truth, belief, knowledge, awareness, and their counterparts (for instance: falsity, doubt, illiteracy, unconsciousness).

[Transformation Rules]^{EX4}:
In the previous example we could recognize some semantic similarity existing among informational processes concerning truth, belief, knowledge, and awareness. For instance, in the case of the definition of information α,

$$(\text{'}\alpha \text{ is\_information'}) =_{Df} ((\alpha \models) \vee (\models \alpha) \vee (\Dashv \alpha) \vee (\alpha \Dashv))$$

it is possible, in a concrete case, to particularize this definition in a non-uniform manner into

$$(\alpha \models_T) \vee (\models_B \alpha) \vee (\Dashv_K \alpha) \vee (\alpha \Dashv_A)$$

or, for instance, expressing it in the form of a parallel metaphysical system

$$\mu \Vdash_T,\ \Vdash_B \mu,\ \dashV_K \mu,\ \mu \dashV_A$$

This could be a natural parallel metaphysical process in which informational cooperation of truth, belief, knowledge, and awareness is coming into existence. Certainly, this can occur not only in the cases in which transformations of modus tollens are taking part.

Within the domain of modus tollens it was possible to observe operational combinations (concatenations) concerning operators of Informing and non-Informing. We can explain the following examples:

$\models_T (\models_B \alpha)$	'it is informed true' that α is believed;
$\models_T (\not\models_B \alpha)$	'it is informed true' that α is not believed;
$\not\models_T (\models_B \alpha)$	'it is not informed true' that α is believed;
$\not\models_T (\not\models_B \alpha)$	'it is not informed true' that α is not believed;
$\models_B (\models_T \alpha)$	it is believed that α ↓is informed true';
$\models_B (\not\models_T \alpha)$	it is believed that α ↓is not informed true';
$\not\models_B (\models_T \alpha)$	it is not believed that α ↓is informed true';
$\not\models_B (\not\models_T \alpha)$	it is not believed that α ↓is not informed true'

Some operationally split cases can be of particular interest. For instance,

$(\models_T \alpha) \models_B$	α 'is informed true' informs believable;
$(\models_T \alpha) \not\models_B$	α 'is informed true' does not inform believable;
$(\not\models_T \alpha) \models_B$	α 'is not informed true' informs believable;
$(\not\models_T \alpha) \not\models_B$	α 'is not informed true' does not inform believable;
$(\alpha \models_B) \models_T$	α informs believable informs true;
$(\alpha \models_B) \not\models_T$	α informs believable does not inform true;
$(\alpha \not\models_B) \models_T$	α informs unbelievable informs true;

$(\alpha \not\models_B) \not\models_T$ α informs unbelievable does *not inform true*

Etc. We can see how particular cases can be operationally reduced. If information informs believable and true, then it can be reduced to inform simply true or simply believable. For instance,

$$\models_T (\models_B \alpha),\ \models_B (\models_T \alpha),\ (\models_T \alpha) \models_B,\ (\alpha \models_B) \models_T$$

could be reduced either into

$$\models_T \alpha \text{ and } \models_B \alpha \text{ or into } \alpha \models_T \text{ and } \alpha \models_B$$

As soon as we have an operator which informs in an untrue or unbelievable manner, a combination of "concatenated" or split operators can be reduced to inform simply untrue or simply unbelievable. For instance, formulae of the above cases

$$\models_T (\not\models_B \alpha),\ \not\models_T (\models_B \alpha),\ \models_B (\not\models_T \alpha),\ \not\models_B (\models_T \alpha),$$
$$(\models_T \alpha) \not\models_B,\ (\not\models_T \alpha) \models_B,\ (\alpha \models_B) \not\models_T,\ (\alpha \not\models_B) \models_T$$

could be reduced either into

$$\not\models_T \alpha \text{ and } \not\models_B \cdot\alpha \text{ or into } \alpha \not\models_T \text{ and } \alpha \not\models_B$$

In cases, where operators inform simultaneously untrue and unbelievable, i.e.,

$$\not\models_T (\not\models_B \alpha),\ \not\models_B (\not\models_T \alpha),\ (\not\models_T \alpha) \not\models_B,\ (\alpha \not\models_B) \not\models_T$$

it is not possible to get a senseful operational reduction. As we can understand, in some particular cases, rules for operational reduction can be constructed. ■

[Transformation Rules]^{EX5}:
We can show how sequences of informational operators can be reduced into a single operator. For instance, if information α is informed aware, known, believable, and true, it can be reduced in the following way:

$$(\models_A (\models_K (\models_B (\models_T \alpha)))) \Rightarrow$$
$$(((\models_A \alpha) \vee (\models_K \alpha) \vee (\models_B \alpha) \vee (\models_T \alpha))$$

The antecedent part of this formula is to be read as follows: it is informed aware that it is informed known that it is informed believable that α is informed true. The shorter meaning would be: α is informed aware, known, believable, and true. Within this example it is possible to recognize the common informational circularity of awareness, knowledge, belief, and truth.

A similar informational phenomenon appears also when such an operator sequence is split. For instance:

$\models_K (\models_T (\alpha \models_B))$ it is known that it is informed true that α informs believable;
$\models_T ((\alpha \models_K) \models_B)$ it is informed true that α informs known informs believable;

etc. Truth, belief, and knowledge are informational entities (processes) which in the realm of living belong to the awareness within a being's metaphysics. ■

[Transformation Rules]^{EX6}:
Now let us examine some contrary operations to truth, belief, knowledge, and awareness. informational entities which inform and are informed in this sense are

$(\alpha \models_T) \vee (\models_T \alpha)$ for truth,
$(\alpha \models_B) \vee (\models_B \alpha)$ for belief,
$(\alpha \models_K) \vee (\models_K \alpha)$ for knowledge, and
$(\alpha \models_A) \vee (\models_A \alpha)$ for awareness

In a similar way it is possible to introduce the contraries of these informational entities, denoting them as

$(\alpha \not\models_T) \vee (\not\models_T \alpha)$ for untruth,
$(\alpha \not\models_B) \vee (\not\models_B \alpha)$ for unbelief,
$(\alpha \not\models_K) \vee (\not\models_K \alpha)$ for ignorance, and
$(\alpha \not\models_A) \vee (\not\models_A \alpha)$ for unawareness

How is it possible to determine subclasses to these informational entities? Let us introduce falsity, doubt, illiteracy, and unconsciousness as particular contraries to truth, belief, knowledge, and awareness:

$(\beta \models_F) \vee (\models_F \beta)$ for falsity,
$(\beta \models_D) \vee (\models_D \beta)$ for doubt,
$(\beta \models_I) \vee (\models_I \beta)$ for illiteracy, and
$(\beta \models_U) \vee (\models_U \beta)$ for unconsciousness

It is probably possible to construct relation of the so-called subinformation (operator ⊂) between falsity and untruth, doubt and unbelief, illiteracy and ignorance, and unconsciousness and unawareness. Thus,

$$(\beta \models_F) \subset (\alpha \not\models_T),\ (\models_F \beta) \subset (\not\models_T \alpha),$$
$$(\beta \models_D) \subset (\alpha \not\models_B),\ (\models_D \beta) \subset (\not\models_B \alpha),$$
$$(\beta \models_I) \subset (\alpha \not\models_K),\ (\models_I \beta) \subset (\not\models_K \alpha),$$
$$(\beta \models_U) \subset (\alpha \not\models_A),\ (\models_U \beta) \subset (\not\models_A \alpha)$$

This example shows the informational power of operator ⊭, which can embrace quite a substantial realm of contrary information. ■

II.4.3.5. The Case of Informational Modus Rectus

> I wish to examine the concept of a system whose behavior can be - at least sometimes - explained and predicted by relying on ascriptions to the system of beliefs and desires (and hopes, fears, intentions, hunches, ...). I will call such systems intentional systems, and such explanations and predictions intentional explanations and predictions, in virtue of the intentionality of the idioms of belief and desire (and hope, fear, intention, hunch, ...).
>
> Daniel C. Dennett [14] 220

In Latin, rectus means something erect, right, proper, appropriate, suitable, intelligent, natural, etc. Informational modus rectus (IMR) will concern direct adjustment (setting, ruling, intentionality) of some experienced (occurred) informational subjectiveness and/or objectiveness. Informationally, IMR concerns informational forms and processes in the realm of belief, desire, intention, etc. being embedded into a living being's metaphysics and within it informationally impacting a living being's behavioral information. In short, IMR concerns belief, desire, intention, etc. and their informational transformation within metaphysical and especially behavioral information. Within these informational circumstances it seems to be worth to examine the nature of the so-called intentional information or intentionality which would be the central notion in connection with the nature of IMR.

Intention is a determination to act in a certain way. Intention is oriented information (i.e. acts in a certain direction). In this sense, information as phenomenology of the living is intentional in general and has its intentionality being impacted by the previous arising of information as information concerning information. Further, intention of information means that certain informational entities within information intend to be more important or significant for the arising of information than others and that they intend to have various impact on their own informational arising.

Informational intentionality means that some information about certain information is arising, thus, that this intentionality concerns the so-called aboutness of certain information. Such an informational aboutness can be a kind of observation, investigation, and comprehension as information of a certain information. Informational intentionality is a particular form or process of counter-information and counter-Informing, which arise within information.

Particular cases of informational intentionality can be clearly informationally distinguished. What are, for instance, beliefs, hopes, cares, hunches, plans, goals, suspicions, knowledge, truth, etc. other than intentional forms of information? Do they impact a being's metaphysics and its behavior? The answer to such questions is by itself a form of intentional information. This means simply that intention of information is its arising, changing, and vanishing during the life cycle of information. The informational modus rectus takes intention as an essential rule or ruling information, which concerns informational transformation not only on the level of living information, but in the case of informational logic also on the level of transformation of iwffs.

[Operands]^{DF5}:
Let us have the following definition:

$$(\text{'}\alpha \text{ is\_intentional\_information'}) =_{Df} ((\alpha \models_{\mathfrak{J}}) \vee (\models_{\mathfrak{J}} \alpha))$$

where $\mathfrak{J}$ is intentional Informing of α (hidden in α), so that $\mathfrak{J} \subset \alpha$. As α is information, for which

$$(\text{'}\alpha \text{ is\_information'}) =_{Df} ((\alpha \models) \vee (\models \alpha))$$

there is, in the case of intentional information,

$$((\alpha \models_{\mathfrak{J}}) \subset (\alpha \models)) \vee ((\models_{\mathfrak{J}} \alpha) \subset (\models \alpha))$$

In these formulae $\mathfrak{J}$ is the informing (or informationally active) component of information α. ■

[Transformation Rules]^{DF10}:
What could be the transformation formulae of modus rectus? One of the possible ways is to proceed from the notion of intention or intentionality. On this way we have to develop an initial philosophy.

Let α be intentional information which hides some intention $\mathfrak{J}$ as an informing part of information α. Intention $\mathfrak{J}$ is a part of α's Informing. Let intentional information α act (inform) upon information β, so, $\alpha \models_{\mathfrak{J}} \beta$. Now, modus rectus is the rule which separates (detaches, reveals) the intention $\mathfrak{J}$ as particular information which informs intentionally within α or is a form of Informing of intentionality α. Thus, the traditional modus rectus can be expressed as

$$\frac{\alpha,\ \alpha \models_{\mathfrak{J}} \beta}{\mathfrak{J}}$$

where α is intentional information and $\mathfrak{J}$ its intention (as information). This formula can be rewritten in a logical manner as

$$\frac{\models_T ((\alpha \models_{\mathfrak{J}}) \vee (\models_{\mathfrak{J}} \alpha)),\ \models_T (\alpha \models_{\mathfrak{J}} \beta)}{\models_T (\mathfrak{J} \subset \alpha,\ \beta)}$$

or in a logically more complete form

$$\models_T ((\models_T ((\models_T ((\alpha \models_{\mathfrak{J}}) \vee (\models_{\mathfrak{J}} \alpha))) \wedge (\models_T (\alpha \models_{\mathfrak{J}} \beta)))) \,/\, (\models_T (\mathfrak{J} \subset \alpha,\ \beta)))$$

where '/' is the detachment operation. There are traces of the intention $\mathfrak{J}$ in α, as well as in β. Information β arises as a consequence of intention $\mathfrak{J}$ within α, which intentionally informs β. The last two formulae enable understanding of the so-called detachment of $\mathfrak{J}$ (or extraction of $\mathfrak{J}$ from the antecedent of modus rectus) as a true informational entity within the informational realm of $\alpha \models_{\mathfrak{J}} \beta$. ■

II.4.3.6. The Case of Informational Modus Obliquus

In Latin, obliquus means slanting, sideways, oblique, indirect, covert, and also envious. Informational modus obliquus (IMO) will concern indirect adjustment (a peculiar or personal point of view, attitude, or opinion) of an absurdly (and individually) experienced informational subjectiveness and/or objectiveness. In this respect, within IMO also a line with a special (oblique) interest will be interpreted or presented. We can say that IMO as an informational transformation is applied from one (specific) side, also with disapproval or distrust. Informationally, IMO concerns informational forms and processes in the realm of unawareness, illiteracy, doubt, and falsity. If modus rectus was a transformation rule in the sense of directness or intentionality, then modus obliquus will be a transformation rule in the sense of indirectness or absurdity.

As a form of indirect rule, modus obliquus deviates from a direct or intentional line of discourse, performing roundabout or not going straight to the point. As an indirect proof, it involves proof of informational entities that negation leads to an absurdity or contradiction. In this manner IMO reveals information which is not openly shown or is to some degree secret.

[Transformation Rules]^{DF11}:
Let α be an absurd or contradictory information defined as

$$('\alpha \text{ is\_absurd\_information}') =_{Df} ((\alpha \models_{\mathfrak{A}}) \vee (\models_{\mathfrak{A}} \alpha)).$$

where $\mathfrak{A}$ is absurdity as information or Informing of information as absurdity. Let τ be information for which it is believed that it informs true ($\models_B (\tau \models_T)$). Then, the rough or traditional form of modus obliquus could be

$$\frac{\tau,\ (\neg\,\tau) \Rightarrow \alpha}{\neg\,\tau}$$

or, more precisely,

$$\frac{\models_B (\tau \models_T),\ (\neg\,\tau) \Rightarrow \alpha}{\tau \not\models_T}$$

We see how in this case it is meaningful to explicate the belief of the true Informing of τ at the beginning of the process of IMO. The last formula of IMO is read in the following way: if it is believed that information τ informs true and if the negation of information τ implies an absurd informational entity α, then τ does not inform true. In this case, the implication of absurdity by negation of τ causes an untrue Informing of τ. The last formula can be rewritten in a logically complete iwff:

$$\models_T (\models_T ((\models_T ((\models_B (((\tau \models) \vee (\models \tau)) \models_T)))) \wedge$$
$$(\models_T ((\neg\,\tau) \Rightarrow ((\alpha \models_{\mathfrak{A}}) \vee (\models_{\mathfrak{A}} \alpha)))))$$
$$/\ (\models_T (((\tau \models) \vee (\models \tau)))))$$

where '/' is the operator of detachment. ■

II.4.3.7. The Case of Informational Modus Procedendi

Informational modus procedendi is a mood of informational detachment by which a goal information is coming into the process of Informing. The Latin procedo has the meaning of to go forth or before, advance, make progress; to continue, remain; and to go on. When informationally proceeding, the process has to go forward by showing the goal in advance. As an informational process, modus procedendi runs on according to a goal information, where this goal information informs, for instance, a motor, behavioral, or simply an acting information and, finally, when the goal is exhausted, elapses.

There exist an infinite number of possibilities how to structure and organize goal-directed informational systems. The task of a modus procendi could be, for instance, how to extract a goal structure and organization from a complex living or artificial informational system, to bring this goal informational structure and organization to the surface, for instance to the logical or conscious level. This could be a senseful informational process of hidden informational goals identification and their use in various life and technological strategies.

[Transformation Rules]^{DF12}:
Let γ be a goal information, where $\models_{\mathfrak{C}}$ is its goal Informing. Now, let us have the following definition of a goal operand variable:

$$('\gamma \text{ is\_goal-expressing\_information}') =_{Df} ((\gamma \models_{\mathfrak{C}}) \vee (\models_{\mathfrak{C}} \gamma))$$

Let α be information (for instance, motor or behavioral operand variable) which must approach or at least consider the goal information, or, as we usually say, must be informed by γ. We can conclude that in some informational elements α has to become informationally similar to γ, thus, $\alpha \mathrel{\therefore_{\mathfrak{C}}} \gamma$. This expression is read as follows: α becomes goal-similar to γ. Under this circumstances α is information approaching to the goal and γ is information which informs α. We can now express informational modus procedendi (IMPr) in the following, traditional form:

$$\frac{\mathfrak{C},\ \gamma \models_{\mathfrak{C}} \alpha}{\alpha \mathrel{\therefore_{\mathfrak{C}}} \gamma}$$

Let us analyze this informational modus! The essential informational entity of the consequent is the operator $\therefore_{\mathfrak{C}}$. This operator has to answer the question, how much has α already approached γ. In this way, modus procedendi has extracted the relation of informational similarity between α and γ. In the antecedent, γ does not arbitrarily inform α, but it has to inform α particularly by the structure and organization of $\mathfrak{C}$. In this respect modus procedendi seems to be much more complex than the previous modi have been. It evidently concerns some parts of Informing of γ (the antecedent of IMPr) as well as of α (the consequent of IMPr).

II.4.3.8. The Case of Informational Modus Operandi

> The reason such an internal selectivity is a major condition on semantic information is that a tokened information structure counts as semantic only if its shape and function in a system can be explained, under appropriate types of regularities, relative to some distal properties. The information structure must therefore be shaped inside the system, by its architecture and modus operandi, in ways which can be explained only by appeal to semantic considerations.
>
> Radu J. Bogdan [13] 98

In Latin, modus operandi means a method of operating or proceeding. This meaning comes near to the concept of algorithm, which is a method of procedure. Evidently, the informational modus operandi (IMOp) has to answer the question what is the aim or essence of informational operation within an informational complex or what is the subject of operation. Thus, IMOp has to extract the operational information, and in regard to this it has to explicate the Informing of information which, in general, informs and is informed. Informational modus operandi reveals the nature of Informing of information. By this explication it becomes informationally known how a certain information informs and is informed. IMOp discovers the informing of information and, in this respect, it is an informational tool for the identification of Informing.

How does an information function? How does it produce informational effects on itself and on informationally involved information? How does it arise and how does it cause arising of other information? How are this informational effects particularized? Informational modus operandi delivers answers to this questions in the form of its consequent. The task of IMOp is, for instance, to discover the algorithm of data processing. However, information cannot be reduced to data, which are static informational entities, which are a collection of operative and informative data. The question is what puts and keeps information in its operation. What are operational operators as concerned their informational structure and organization?

[Transformation Rules]^{DF13}:
What is Informing $\mathfrak{I}$ (or $\mathfrak{I}_\alpha$) of information α? Informing $\mathfrak{I}$ is nothing else but an informational functionality $\mathfrak{F}$ of α, thus,

$$\mathfrak{I} = \mathfrak{F}(\alpha)$$

In this sense, Informing $\mathfrak{I}$ is an implicit informational operator of α which is a product of α and which as an active part of information produces α. In this respect, the basic definition of information α can be expressed also as

$$(\text{'}\alpha \text{ is\_information'}) =_{Df} ((\alpha \models_{\mathfrak{F}(\alpha)}) \vee (\models_{\mathfrak{F}(\alpha)} \alpha))$$

This would have the meaning that α informs and is informed in virtue of its own functionality.

Informing $\mathfrak{I}$ of information α means that information α counter-informs itself and that it embeds the produced counter-information. This is the known principle of informational cyclicity. Within this philosophy, counter-Informing of α, denoted as $\mathfrak{C} = \mathfrak{C}(\alpha)$, and informational embedding $\mathfrak{E} = \mathfrak{E}(\alpha)$ of the counter-informed counter-information γ are sub-Informings of $\mathfrak{I}$, thus,

$$\mathfrak{C}, \mathfrak{E} \subset \mathfrak{I}$$

When discovering $\mathfrak{I}$, informational modus operandi has to reveal components $\mathfrak{C}$ and $\mathfrak{E}$ of Informing $\mathfrak{I}$ to answer the question about the nature of α's Informing. In this procedure IMOp asks for the cyclic structure and organization of information α. The most simple form of IMOp in the case of α's self-Informing is

$$\frac{\alpha, \alpha \models_{\mathfrak{I}} \alpha}{\mathfrak{C}, \mathfrak{E} \subset \mathfrak{I}}$$

The cyclic complexity of α's cyclic parallel Informing $\mathfrak{I}$, considering its counter-Informing $\mathfrak{C}$ and informational embedding $\mathfrak{E}$, can be chosen as follows:

$$\alpha \Vdash_\alpha \mathfrak{I},\ \ \alpha, \mathfrak{I} \Vdash_{\mathfrak{I}} \mathfrak{I}, \alpha,\ \ \alpha, \mathfrak{I} \Vdash_{\mathfrak{I}} \mathfrak{C},$$
$$\alpha \Vdash_{\mathfrak{C}} \gamma,\ \ \alpha, \mathfrak{I}, \gamma \Vdash_\alpha \mathfrak{E},\ \ \gamma \Vdash_{\mathfrak{E}} \alpha$$

IMOp has to explore this cyclic informational domain since $\mathfrak{I}$ can be identified considering also its instantaneous components $\mathfrak{C}$ and $\mathfrak{E}$. ■

[Transformation Rules]^{DF14}:
The next cases, which are much more complex than the previous one, concern the question how does information α inform other information β, i.e., $\alpha \models \beta$ and, in general, $\alpha \models \xi, \eta, \ldots, \zeta$. If the previous rules concerned self-Informing, the subsequent ones will concern one-way inter-Informing of information. Let us introduce the following tokens:

$\mathfrak{I}_\alpha$ or $\mathfrak{I}(\alpha)$ will mark the Informing of information α;
$\mathfrak{C}_\alpha$ or $\mathfrak{C}(\alpha)$ will mark the counter-Informing of information α; and
$\mathfrak{E}_\alpha$ or $\mathfrak{E}(\alpha)$ will mark the informational embedding of information α

In the case of the one-way Informing of information α to information β, the following rule of informational modus operandi can be constructed:

$$\frac{\alpha, \beta; \alpha \models_{\mathfrak{I}(\alpha)} \beta}{\mathfrak{C}_\alpha, \mathfrak{E}_\alpha \subset \mathfrak{I}_\alpha; \mathfrak{C}_\beta, \mathfrak{E}_\beta \subset \mathfrak{I}_\beta}$$

This form of IMOp has to consider the following complexities: the cyclic complexity of α's cyclic parallel Informing $\mathfrak{I}_\alpha$ (coming into existence in virtue of $\alpha \models \alpha$), considering the counter-Informing $\mathfrak{C}_\alpha$ and informational embedding $\mathfrak{E}_\alpha$; the one-way complexity of α's (linear) parallel Informing of β (coming into existence in virtue of $\alpha \models \beta$); and the cyclic complexity of β's cyclic parallel Informing $\mathfrak{I}_\beta$ (coming into existence in virtue of $\beta \models \beta$), considering the counter-Informing $\mathfrak{C}_\beta$ and informational embedding $\mathfrak{E}_\beta$. This complexity can be expressed by the following parallel system:

$$\alpha \Vdash_\alpha \mathfrak{I}(\alpha);\ \alpha, \mathfrak{I}(\alpha) \Vdash_{\mathfrak{I}(\alpha)} \mathfrak{I}(\alpha), \alpha;$$
$$\alpha, \mathfrak{I}(\alpha) \Vdash_{\mathfrak{I}(\alpha)} \mathfrak{C}(\alpha);$$
$$\alpha \Vdash_{\mathfrak{C}(\alpha)} \gamma_\alpha;\ \alpha, \mathfrak{I}(\alpha), \gamma_\alpha \Vdash_\alpha \mathfrak{E}(\alpha);\ \gamma_\alpha \Vdash_{\mathfrak{E}(\alpha)} \alpha;$$

$$\alpha \Vdash_\alpha \mathfrak{I}(\beta);\ \alpha, \mathfrak{I}(\alpha) \Vdash_{\mathfrak{I}(\alpha)} \mathfrak{I}(\beta), \beta;$$
$$\alpha, \mathfrak{I}(\alpha) \Vdash_{\mathfrak{I}(\alpha)} \mathfrak{C}(\beta);$$
$$\alpha \Vdash_{\mathfrak{C}(\alpha)} \gamma_\beta;\ \alpha, \mathfrak{I}(\alpha), \gamma_\alpha \Vdash_\alpha \mathfrak{E}(\beta);\ \gamma_\alpha \Vdash_{\mathfrak{E}(\alpha)} \beta;$$

$$\beta \Vdash_\beta \mathfrak{I}(\beta);\ \beta, \mathfrak{I}(\beta) \Vdash_{\mathfrak{I}(\beta)} \mathfrak{I}(\beta), \beta;$$
$$\beta, \mathfrak{I}(\beta) \Vdash_{\mathfrak{I}(\beta)} \mathfrak{C}(\beta);$$
$$\beta \Vdash_{\mathfrak{C}(\beta)} \gamma_\beta;\ \beta, \mathfrak{I}(\beta), \gamma_\beta \Vdash_\beta \mathfrak{E}(\beta);\ \gamma_\beta \Vdash_{\mathfrak{E}(\beta)} \beta$$

In this system, two essentially different parallel informational operators appear, namely, $\Vdash$ for cyclic and $\models$ for general parallel

Informing. It is certainly possible that also inter-informational parallel Informing can become cyclic, when a circular Informing between two informational entities is introduced. In this case we can say that simultaneously $\alpha \models \beta$ and $\beta \models \alpha$ are taking place. This can be our next case of IMOp. ■

[Transformation Rules]^{DF15}:
In the case of the two-way or intercyclic Informing between informational entities α and β, the following rule of IMOp can be constructed:

$$\frac{(\alpha,\ \beta),\ (\alpha \models_{\mathfrak{I}(\alpha)} \beta,\ \alpha \mathrel{=\!\!|}_{\mathfrak{I}(\beta)} \beta)}{\mathfrak{C}_\alpha,\ \mathfrak{E}_\alpha \subset \mathfrak{I}_\alpha;\ \mathfrak{C}_\beta,\ \mathfrak{E}_\beta \subset \mathfrak{I}_\beta}$$

This form of IMOp has to consider the following complexities: the cyclic complexity of α's cyclic parallel Informing $\mathfrak{I}_\alpha$ (coming into existence in virtue of $\alpha \models \alpha$), considering the counter-Informing $\mathfrak{C}_\alpha$ and informational embedding $\mathfrak{E}_\alpha$; the one-way complexity of α's (apparently linear, but in fact inter-informationally circular) parallel Informing of β (coming into existence in virtue of $\alpha \models \beta$); the one-way complexity of β's (apparently linear, but in fact circular) parallel Informing of α (coming into existence in virtue of $\beta \models \alpha$); and the cyclic complexity of β's cyclic parallel Informing $\mathfrak{I}_\beta$ (coming into existence in virtue of $\beta \models \beta$), considering the counter-Informing $\mathfrak{C}_\beta$ and informational embedding $\mathfrak{E}_\beta$. This complexity can be expressed by the following parallel system:

$$\alpha \Vdash_\alpha \mathfrak{I}(\alpha);\ \alpha,\ \mathfrak{I}(\alpha) \Vdash_{\mathfrak{I}(\alpha)} \mathfrak{I}(\alpha),\ \alpha;$$
$$\alpha,\ \mathfrak{I}(\alpha) \Vdash_{\mathfrak{I}(\alpha)} \mathfrak{C}(\alpha);$$
$$\alpha \Vdash_{\mathfrak{C}(\alpha)} \Upsilon_\alpha;\ \alpha,\ \mathfrak{I}(\alpha),\ \Upsilon_\alpha \Vdash_\alpha \mathfrak{E}(\alpha);\ \Upsilon_\alpha \Vdash_{\mathfrak{E}(\alpha)} \alpha;$$

$$\alpha \Vdash_\alpha \mathfrak{I}(\beta);\ \alpha,\ \mathfrak{I}(\alpha) \Vdash_{\mathfrak{I}(\alpha)} \mathfrak{I}(\beta),\ \beta;$$
$$\alpha,\ \mathfrak{I}(\alpha) \Vdash_{\mathfrak{I}(\alpha)} \mathfrak{C}(\beta);$$
$$\alpha \Vdash_{\mathfrak{C}(\alpha)} \Upsilon_\beta;\ \alpha,\ \mathfrak{I}(\alpha),\ \Upsilon_\alpha \Vdash_\alpha \mathfrak{E}(\beta);\ \Upsilon_\alpha \Vdash_{\mathfrak{E}(\alpha)} \beta;$$

$$\mathfrak{I}(\alpha) \Dashv_\beta \beta;\ \mathfrak{I}(\alpha),\ \alpha \Dashv_{\mathfrak{I}(\beta)} \beta,\ \mathfrak{I}(\beta);$$
$$\mathfrak{C}(\alpha) \Dashv_{\mathfrak{I}(\beta)} \beta,\ \mathfrak{I}(\beta);$$
$$\Upsilon_\alpha \Dashv_{\mathfrak{C}(\beta)} \beta;\ \mathfrak{E}(\alpha) \Dashv_\beta \beta,\ \mathfrak{I}(\beta),\ \Upsilon_\beta \bot\ \alpha \Dashv_{\mathfrak{E}(\beta)} \Upsilon_\beta;$$

$$\beta \Vdash_\beta \mathfrak{I}(\beta);\ \beta,\ \mathfrak{I}(\beta) \Vdash_{\mathfrak{I}(\beta)} \mathfrak{I}(\beta),\ \beta;$$
$$\beta,\ \mathfrak{I}(\beta) \Vdash_{\mathfrak{I}(\beta)} \mathfrak{C}(\beta);$$
$$\beta \Vdash_{\mathfrak{C}(\beta)} \Upsilon_\beta;\ \beta,\ \mathfrak{I}(\beta),\ \Upsilon_\beta \Vdash_\beta \mathfrak{E}(\beta);\ \Upsilon_\beta \Vdash_{\mathfrak{E}(\beta)} \beta$$

In this system parallel cyclic operators $\Vdash$ and $\Dashv$ can be introduced since α and β are cyclically interwoven in an informational manner. Maybe the last example seems clumsy, but it shows a rich complexity in the case of inter-informational activity. This kind of complexity must certainly be considered in a case of informational reality. ■

It is evident that informational complexity for a general case $\alpha, \beta, \ldots, \gamma \models \xi, \eta, \ldots, \zeta$ and $\alpha, \beta, \ldots, \gamma \mathrel{=\!\!|} \xi, \eta, \ldots, \zeta$ can enormously grow. Identification of appearing inter-informational forms of Informing calls for particular rules of informational modus operandi.

II.4.3.9. The Case of Informational Modus Vivendi

> How could the vital goal of staying alive or that of enjoying oneself shape any sort of information? Vital goals are satisfied only when active, specific goals are.
>
> Radu J. Bogdan [13] 92

Informational modus vivendi concerns information of life in environmental, individual, populational, and social circumstances. Several levels and sorts of life information can certainly be distinguished. The basic living information present everywhere where the living arises may be marked as autopoietic information α. This information may be compared to basic informational fuel of which any higher living informational forms and processes are composed and aggregated. This informational fuel includes the most elementary and primitive informational lumps, living informationally related and unrelated in their biological environment and out of which, during a life cycle, higher and more complex informational forms and processes would come into existence.

We can imagine, for instance, how in a living being its total information called metaphysics μ is permanently arising out of informational lumps within its autopoietic system, where α is coming into existence, changing, and vanishing. This metaphysics μ represents a life related informational form and process of autopoietic information α. In these circumstances, α together with stimulus or sensory information σ enables the coming of metaphysics μ into existence. Through life processes, α and σ structure and organize μ, thus, as we say, inform μ. In general,

$$\alpha,\ \sigma \models \mu$$

At first, this process could be seen as an initial process of metaphysical development of a living unit. As soon as μ begins to develop, it begins to impact a being's autopoietic system, i.e., its autopoietic information α, and it begins to filter and modulate metaphysically the sensory information σ. So, to the initial process, the process

$$\mu \models \alpha,\ \sigma$$

can be attributed.

Further, an essential part of metaphysics μ is the so-called behavioral or motor information β, by which a being performs its acting (intelligent deciding) within its autopoietic system and in its environment. In processes of life all informational occurrences of a living being interact, so, a general living system can be demonstrated informationally in the form

$$\alpha,\ \sigma,\ \mu,\ \beta \models \alpha,\ \sigma,\ \mu,\ \beta$$

This informational system can be decomposed into basic interacting parallel processes, for instance,

$\alpha \Vdash \alpha,\ \alpha \Vdash \sigma,\ \alpha \Vdash \mu,\ \alpha \Vdash \beta,$
$\sigma \Vdash \alpha,\ \sigma \Vdash \sigma,\ \sigma \Vdash \mu,\ \sigma \Vdash \beta,$
$\mu \Vdash \alpha,\ \mu \Vdash \sigma,\ \mu \Vdash \mu,\ \mu \Vdash \beta,$
$\beta \Vdash \alpha,\ \beta \Vdash \sigma,\ \beta \Vdash \mu,\ \beta \Vdash \beta$

This system says that not only informational entities α, σ, μ, and β interact, but that also their Informings $\Im_\alpha$, $\Im_\sigma$, $\Im_\mu$, and $\Im_\beta$ interact within the informational parallelism of the basic processes $\alpha \Vdash \alpha$, $\alpha \Vdash \sigma$, ... , $\beta \Vdash \mu$, $\beta \Vdash \beta$.

The basic system being described can be broadened into the form

$\alpha \Vdash \alpha,\ \Im_\alpha;\ \alpha \Vdash \sigma,\ \Im_\sigma;\ \alpha \Vdash \mu,\ \Im_\mu;\ \alpha \Vdash \beta,\ \Im_\beta;$
$\sigma \Vdash \alpha,\ \Im_\alpha;\ \sigma \Vdash \sigma,\ \Im_\sigma;\ \sigma \Vdash \mu,\ \Im_\mu;\ \sigma \Vdash \beta,\ \Im_\beta;$
$\mu \Vdash \alpha,\ \Im_\alpha;\ \mu \Vdash \sigma,\ \Im_\sigma;\ \mu \Vdash \mu,\ \Im_\mu;\ \mu \Vdash \beta,\ \Im_\beta;$
$\beta \Vdash \alpha,\ \Im_\alpha;\ \beta \Vdash \sigma,\ \Im_\sigma;\ \beta \Vdash \mu,\ \Im_\mu;\ \beta \Vdash \beta,\ \Im_\beta$

where $\Im_\xi$, $\xi \in \{\alpha, \sigma, \mu, \beta\}$ is Informing of information in question. This parallel informational system can further be decomposed (particularized) into more and more details.

It has to be stressed again that autopoietic information α is a kind of basic architectural, molecularly structured and by molecular processing organized information of a living being - also of a living cell. Information α is a matter of molecular processes within complex molecules of life, microtubules, cell lumps and generally subunits of the cell as entirety, etc.

In constructing various kinds of informational modi vivendi, living informational components α, σ, μ, and β can be considered as basic elements or a background of specialized and dedicated living informational entities. On higher levels of living structure and organization, e.g., on the level of higher cortical processes, modus vivendi embraces all of the imaginable modi informationis where each special modus can be a part or a function of modus vivendi. The information, which living beings are capable to produce, is in principle only autopoietic, thus its arising is under the impact of such or another modus vivendi in a particular time slice (step of development) and within a particular environment. What a living being thinks, hypothesizes, does, performs, informationally adopts, etc., can arise only within the realm of its autopoietically informational.

In this section we shall not discuss other specific modi informationis (ponens, tollens, rectus, etc.), but will concentrate to revealing some specific and elementary life processes, which originate, preserve, and destruct life, i.e., the real and essential forms of modus vivendi.

As a modus informationis we have determined an iwff which uses the so-called fractional (detachment) or extractive line operation. Now, cases of modus vivendi have to be constructed in this standard way.

[Transformation Rules]$^{\mathrm{DF16}}$:
Let α, σ, μ, and β be autopoietic, sensory (stimulus), metaphysical, and behavioral (motor) information, respectively. It is to understand that after its conception metaphysics μ is certainly being informationally embedded in autopoietic information α. In the very beginning of a being's conception, when only its autopoietic information arises, its beginning metaphysics is coming into existence. This fact can be expressed by the modus

(1) $$\frac{\alpha,\ \alpha \models \mu}{\mu}$$

The meaning of this modus is the following: if there exists autopoietic information α and if α informs metaphysics μ, then there exists μ. This modus has to be conjoined with the axiom

(1a) $$((\alpha \models) \vee (\models \alpha)) \Rightarrow (\alpha \llcorner \mu)$$

which governs the conception of metaphysics μ and says the following: if α is autopoietic information (if it informs and is informed), then α causes the appearance of μ or, cuases μ to come into existence by Informing of α. This property of autopoietic information, to conceive its metaphysics, exists as its own intention and is a way of its Informing and informational development.

At the conception of a being's metaphysics μ also Informing of autopoietic information α and Informing of arising metaphysics μ can be considered in the operationally explicit way, by the following modus:

(2) $$\frac{\alpha \models,\ (\alpha \models \mu) \models}{\mu \models}$$

The meaning of this formula is as follows: if α informs (arises) and if the process $\alpha \models \mu$ informs (arises), then μ informs (arises) as well. This conclusion is important because $\mu \models$ does not follow explicitly from the antecedent of the last modus. In fact, to this modus the following axiom can be conjoined:

(2a) $$\begin{array}{c}(((\alpha \models) \models) \vee (\models (\alpha \models)) \vee \\ ((\models \alpha) \models) \vee (\models (\models \alpha))) \\ \Rightarrow (((\alpha \models) \vee (\models \alpha)) \llcorner ((\mu \models) \vee (\models \mu)))\end{array}$$

Although the consequence of the last implication is not essentially different from the consequence of (1a), it can be read differently, namely, that complex Informing of α causes the appearance of complex Informing of μ. However, complex Informing of information is nothing else but information itself.

As in an environment autopoietic information α and metaphysics μ conceived by it are always arising, the impact of sensory information on metaphysics is taking place:

(3) $$\frac{(\alpha,\ \sigma),\ (\alpha,\ \sigma \models \mu)}{\mu}$$

If autopoietic information α and sensory information σ exist and if they inform metaphysics μ, then metaphysics μ exists or performs as information impacted by α and σ. This modus can be conjoined by the axiom

(3a) $((\alpha \models) \vee (\models \alpha) \vee (\sigma \models) \vee (\models \sigma)) \Rightarrow (\alpha, \sigma \mathrel{L} \mu)$

This axiom seems to be informationally more accurate than axiom (1a), however, we have to consider that axiom (1a) was the very beginning of the conception of metaphysics. In fact, axiom (3a) is an iwff describing the continuation of conceptional formation of metaphysics and has the following meaning: if α is autopoietic information which has already conceived its metaphysics μ, then in further process of conception, α together with sensory information σ informationally impacts metaphysics μ. In this respect (3a) is a sequel of (1a). On the other hand, (3a) can be seen as a particularization of (1) where α was substituted by α, σ. Thus, modus (3) has the semantic value because it shows the impact of α as well as σ on extraction of μ.

Similarly to modus (2) it is possible to broaden modus (3) to the Informings of impacting and impacted informational components. Thus, the following modus is obtained:

(4) $$\frac{(\alpha \models, \sigma \models), (\alpha, \sigma \models \mu) \models}{\mu \models}$$

This formula is a particularization of modus (2), where $\alpha \models$ was substituted by $\alpha \models, \sigma \models$ and α by α, σ. This modus has the semantic value in showing the impact of antecedent Informings on consequent Informing of μ. As in previous cases, this modus can be conjoined with the axiom

(4a) $$\begin{array}{l} (((\alpha \models) \models) \vee (\models (\alpha \models)) \vee \\ ((\models \alpha) \models) \vee (\models (\models \alpha)) \vee \\ ((\sigma \models) \models) \vee (\models (\sigma \models)) \vee \\ ((\models \sigma) \models) \vee (\models (\models \sigma))) \\ \Rightarrow (((\alpha \models) \vee (\models \alpha) \vee (\sigma \models) \vee (\models \sigma)) \\ \quad \mathrel{L} ((\mu \models) \vee (\models \mu))) \end{array}$$

As the conception of μ is progressing it becomes more and more clear that particular modi vivendi must satisfy the basic expression of the living, namely,

$$\alpha, \sigma, \mu, \beta \models \alpha, \sigma, \mu, \beta \quad \blacksquare$$

[Transformation Rules]^{DF17}:
Let us list several other modi vivendi explicating Informings of vital informational components. For autopoietic information α there is the basic modus

$$\frac{\alpha}{\alpha \models \mathfrak{I}_\alpha}$$

It means that autopoietic information α informs (generates, observes, also autopoietically limits) its own Informing $\mathfrak{I}_\alpha$. This modus is informationally regular, for Informing $\mathfrak{I}_\alpha$ is an implicit component of living information. This is the known principle of Informing of information [4, 11]. The last modus is informationally regular, for Informing $\mathfrak{I}_\alpha$ is only an implicit operational component of α, hidden in α (in the antecedent of the last formula). Thus, this modus means explication or extraction of the component hidden in α. This concealment could be considered, for instance, by the formula

$$\alpha = \alpha(\mathfrak{I}_\alpha)$$

Similarly as in previous transformation rule, now it is possible to reveal modi concerning Informings of autopoietic and metaphysical information. Thus,

$$\frac{\alpha \models \mathfrak{I}_\alpha, \alpha \models \mu}{\mathfrak{I}_\alpha \models \mu}$$

In course of conception of metaphysics, by metaphysics, its Informing is coming into existence, and the following modus can be observed:

$$\frac{(\alpha, \sigma), (\alpha, \sigma \models \mu)}{\mu \mathrel{L} \mathfrak{I}_\mu}$$

Finally, within autopoietic information α, and metaphysics μ embedded in it, as well as a consequence of appearing sensory information σ, information of a being's behavior β is coming into existence as a reaction to all of these informational circumstances. We suppose that the conception of β begins by μ and we can adopt the following axiom:

$$(\alpha, \sigma, \mu \models \mu) \Rightarrow (\mu \mathrel{L} \beta)$$

Afterwards, we can introduce the following modus:

$$\frac{(\alpha, \sigma, \mu), (\alpha, \sigma, \mu \models \beta)}{\beta}$$

This modus assures the existence of behavioral information β. It becomes evident that after this discussion different informational axioms arise concerning information of the living. For instance,

$$(\alpha \models) \Rightarrow (\mathrel{L} \mu)$$
$$(\mu \models) \Rightarrow (\mathrel{L} \beta)$$
$$((\alpha \models) \vee (\sigma \models)) \Rightarrow ((\mathrel{L} \mu) \vee (\mathrel{L} \beta))$$

etc. ■

Examples of different modi vivendi have shown that modus vivendi above all presents a case being semantically bound to living being. The exposed cases of modus vivendi retain their meaning also in a more general informational sense, for arising of information is a living as well as cosmic and artificial phenomenon.

In this section we have discussed only very general forms of modus vivendi. We did not examine concrete modi, concerning higher intellectual functions and higher forms of life. Modus vivendi concerns any realm of living activity and can certainly be concretized for any field, form, or process referring to a living being.

II.4.3.10. The Case of Informational Modus Possibilitatis

Possibility is a modal determination which opposes reality (essential, existential) and necessity. Modality by itself is a mood of revealing of Being, occurrence, or thinking; it is a mood of conditionality. In logic, modality of propositions means the degree of trustability of propositions in regard to possibility (e.g., a problematic proposition is $\alpha \models_\pi \beta$ or $\alpha =_\pi \beta$ with the meaning α can be β), existence (e.g., an asserting proposition is $\alpha = \beta$ with the meaning α is β), and to necessity (e.g., an apodictic proposition is $\alpha \models_{must\_be} \beta$ with the meaning α must_be β). According to Kant, categories of modality are possibility/impossibility, existence/non-existence, and necessity/chance. In psychology, modality is a common domain of quantitatively related sensations, conditioned by functions of certain organs, for instance, sensations of sight, hearing, etc.

In formal-informational sense, possibility means that something, which is informational, can always be informed or can come into existence as a new informational subject and object, irrespective to its particular nature of counter-Informing and informational embedding. A cognitive-theoretical or material-objective possibility is only a particular information which can arise irrespectively to a concrete metaphysical experience which might be or might not be a reference versus arising possibility. Metaphysics as a total information of a being certainly conditions the possibility of informational arising according to the autopoietic informational nature of a being. As information possibility is a potential dynamics of information to arise into a new, unforeseeable and foreseeable informational phenomenon.

[Transformation rules]^{DF18}:
The basic question of informational possibility is the following: if α is information, how can it arise. In fact, informational possibility and informational arising concern a common and essential question of information. Information can arise in various ways. The possibility of this arising is impacted by Informing of α by itself and by Informing of other information β which can possibly impact α. If $\alpha, \beta \models \alpha$, then α can arise into any particular information, information γ, for instance; thus

$$\alpha, \beta \models \alpha \models_\pi \gamma$$

The possibility of Informing of α is hidden within the informational process $\alpha \models \gamma_\pi$, where γ is the possible information. Informational modus possibilitatis has to detach possible information. If γ unites possible information, then it marks an informational set of possible informational entities, for instance, $\gamma_1, \gamma_2, \ldots, \gamma_n$, which are samples of possible entities. These entities can be informationally conjoined or interwoven. Thus, possibility γ hides possibilities $\gamma_1, \gamma_2, \ldots, \gamma_n$.

An example of informational modus possibilitatis can be the following:

$$\frac{\alpha, \beta;\ \alpha, \beta \models \alpha \models_\pi \gamma}{\gamma \models_\pi \gamma_1, \gamma_2, \ldots, \gamma_n}$$

Informational modus possibilitatis answers the question what is informationally possible. According to philosophy of informational logic, any (also unforeseeable) informational arising is possible, it means, any arising, which leads to the appearance of counter-informational, contrary, absurd information, etc. Further, possible information is probable as well as improbable information, whose informational framework can be sensed or felt or can stand outside of a metaphysical imagination, which may happen and which is unforeseeable, informationally not yet revealed. ■

II.4.3.11. The Case of Informational Modus Necessitatis

The 'must' is compelled by necessity. Necessity as information is a pressure of informational circumstances, is informational impossibility (also incapability) of a contrary information. It is an urgent informational need and desire, in such a way, that it cannot be otherwise. Necessity can be comprehended as an inevitable informational consequence.

Informationally, necessity is a mood of revealing and functioning of reality, Being, essentialness, etc. It is a mood of principles and informationally constructed legality of various informational systems imagined as they function orderly in reality. Necessity can be, for instance, a form of fatalism, a deterministic conception, by which existence and arising of information are understood as a necessary (predetermined) phenomenology which informs as such in the past, present and future. These concepts of necessity can reject chance and also possibility as categories of objectiveness. Dialectically, necessity is comprehended to relate chance and possibility according to reality of life where a living being can estimate various possibilities and can make determined decisions. Further, necessity can also be conceived as a form of informational repression.

[Transformation Rules]^{DF19}:
Let us introduce the following definition:

$$(\text{'}\nu \text{ is\_information\_of\_necessity'}) =_{Df} ((\nu \models_N) \vee (\models_N \nu)$$

where N is the Informing of necessity as information within ν. Now, let information α be informed by ν, thus, $\nu \models_N \alpha$. We say that in this case α is N-deterministic (necessity-deterministic). Certainly, it is possible to construct various rules of modus necessitatis. Let us take the following example:

$$\frac{\nu, \nu \models_N \alpha}{\alpha \therefore_N \nu}$$

If ν is information of necessity (necessary information) and if this information informs, by necessity N, another information α, then information α is informationally compatible in regard to information ν. In this case, it is said that ν and α support informationally the so-called informational kernel of necessity. ■

Within a formal theory, it is necessary to follow its axioms and rules of transformation, otherwise the theory can expose inadmissible contradictions. Within an ideology, it is necessary to develop only ideologically permissible information which is informed by virtue of ideological kernel.

II.4.3.12. Cases of Informational Modus Informationis

Cases of different elementary modi informationis have been presented, from the informational modus ponens to the informational modus necessitatis. From these elementary modi it is possible to construct mixed modi informationis (for instance, modus ponendo ponens, modus ponendo tollens, modus tollendo tollens, modus tollendo ponens, modus ponendo rectus, etc.) and compose them to more and more sophisticated informational rules for iwff transformation.

On the other side, we have to keep in mind that information by itself is a transformational entity which, besides of the previously explicated cases of modus informationis, develops itself and is developing other and developed by other informational entities. Modus informationis is just another constructive look at the same problem, namely, at informational arising. However, in a concrete case, modus informationis is a transforming system in Informing of iwffs in the framework of the concrete case. Certainly, there exist an indefinite number of cases of modus informationis where their antecedent and consequent parts are thrown into spontaneous and circular Informing with an instantaneous intentionality of living or artificial information. Besides of transformational arising of informational parts within a certain information, the general and particular informational entities can always be additionally particularized and universalized in a new way. This principle of particularization and universalization may come close to the intention of designing living and particularly artificial information.

II.4.3.13. Conclusion Concerning Modus Informationis

Through the transformation principle of modus informationis we have opened the real abyss of developmentally extracting possibilities, where information is extracted from information by the way of informational arising. In this regard modus informationis is another essential principle of informational arising for it seizes into the elementary philosophy of informational phenomenology. In fact, it helps to reveal concepts of a discrete Informing of informational entities which informationally develop in themselves. In this manner, modus informationis contributes also to explanation of the concept of informational arising. It is possible to say that modus informationis is a part of explanation which concerns the most general informational metaoperator $\models$.

II.4.4. Rules of Informing

Rules of Informing as introduced in the form of informational axioms and transformation rules of IL concern a specific, theoretically and symbolically logical nature of Informing of information. These rules remain open to the processes of their further informational development (arising) and, certainly, of their particularization and universalization. In fact, any process of Informing is performed as an informational rule upon informational units within an informational domain. Thus, Informing by itself can be understood as an instantaneous rule applied spontaneously and circularly upon instantaneous informational entities.

II.4.4.1. Openness of Introducing New Transformation Rules

The transformation rules determined in the previous paragraphs show the possibilities of their indefinite continuation of development. Beside of the existing cases of transformational detachability new and much more complex informational transformations are possible. It is, of course, also possible to add new transformational types to the detaching ones. Modus informationis as a general principle of Informing can embrace variously imaginable rules for transformational arising of information. The consequence of these possibilities is that a transformational system remains open for new transformational determinations. On this basis it is possible to conclude that informational transformation, as presented in the previous cases, irrespective of the informational system (theory, mind, behavior, etc.) involved, remains open in the informational sense. This informational phenomenon enables to open new principled questions concerning the nature of possible informational transformation.

The basis of informational transformation of IL remains developmentally open. Principles of informational particularization and universalization concern informational transformation rules in the same sense as they concern information and its Informing in general. They are a constructively senseful component of keeping the transformation basis open. Thus, the exposed informational transformation rules perform as regular information. They are informational.

II.4.4.2. Transformation Rules and Metaphysical Beliefs

Certainly, the listed transformational cases arise from a particular metaphysical disposition from which they are thrown as cases of modus informationis into a broader scientific, professional, and philosophical discourse. Where are the limits of informational arising of discussed transformation rules? The answer is that only in the metaphysics which dwells and develops on its autopoietic foundation. Beliefs, intentions, and desires cause their creation. Some principles of their creation seem to be evident, at least some very primitive ones. In this sense, informational transformation rules can preserve their developmental and arising power, of course, being impacted by their cultural environment.

We have recognized how informational modi can be developed from some ancient and also modern, for instance, mathematical principles of inference, proof theory, and common sense. In each case, these modi have been informationally (conceptually) broadened, and did not stay only on their traditionally philosophical and mathematical foundations. The traditional meaning of these modi was preserved in their most primitive forms, but they could be developed in a more general way and preserving not only traditional logical relations. It is relevant to stress that modi informationis became a regular arising of information.

II.5. A SURVEYING CONCLUSION CONCERNING THE FORMAL INFORMATIONAL LOGIC

The informational logic presented in this essay has not always been placed inside of the strict traditional rationalism and has not built any protective ditch against the possibilities of its further development, arising, and theoretical improvement. In this respect it was in no way closed as a sulky routine of logical positivism being characteristic for some Western posts of the angry common sense. This means that IL stands on a broadened theoretical ground of a sound reasoning. The most relevant theoretical origin of IL was the construction of its axiomatizational and transformational possibilities of informational entities which root in the phenomenology of the entire information of a being, in the so-called being's metaphysics. By such a way of formalization, to IL was given the semantic nature of informational arising on the level of informational operands as well as on the level of informational operators. The most general operational variable of informational arising was the operator $\models$ which became also an inward property of operand information α as an arising entity. To stress clearly, this was the most relevant innovation to the formalistic conception of information and Informing of information, where $\models$ as operational variable obtained the possibility to be particularized and universalized.

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